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INVESTIGATION OF THE EFFECT OF AIR POLLUTION ON THE HEALTH OF CHILDREN

[This is a translation of an article written by K. A. Moskovskaya in Trudy Leningradskogo Sanitarno-Gigiyenicheskogo Meditsenskogo Instituta (Works of the Leningrad Sanitary Hygienic Medical Institute), Vol 31, Leningrad, 1956, pages 36-40.]

In connection with the continuous development of various sections of the national economy and the increased number and capacity of industrial enterprises, there has been a rise in the air pollution of industrial cities.

Soviet hygienic science, in addition to other problems of health protection of the population, is also concerned with protection of the purity of air in populated places. For over 25 years systematic studies have been conducted in hygienic institutes and laboratories in regard to air pollution by aerosols and noxious gases of cities and areas where industrial enterprises are located. In regard to gaseous air pollution of cities, the greatest attention has been paid to carbon monoxide fumes and sulfuric anhydride. The effect of carbon monoxide on the organism has been studied by many authors, including Z. G. Vol'fson (1936) in Moscow and A. S. Lykova (1953) in Leningrad.

The effect of small concentrations of sulfur dioxide within a radius of 2,000 to 2,600 meters from the dumping site was studied by Babayants (1948), Sarayer-Romann, and Gasel'gof-Lindau; the results of these observations were published by Ryazanov (1954), etc. One noted in these studies the destruction of plant cells and falling of coniferous leaves, retardation of growth, and profound structural changes of trees and plants.

By using concentrations considerably above the liminal degree of irritation in their experiments on animals (rabbits), Nikulina, Getman and Margolina demonstrated (1934) that sulfur dioxide affects metabolism in causing acidosis, hyperglycemia, reduction of the catalase figure, and an increase of the lactic acid level in the blood. Sidorenko arrived at similar conclusions (1952). Studies by Volkova showed that sulfur dioxide of one to five mg/m^3 concentrations

exerts a negative effect on the central nervous system.

According to data in the literature, considerable pollution has been detected in the air of industrial cities and in the vicinity of industrial enterprises. Thus, for example, the quantity of aerosols in Leningrad, according to Babayants (1944), fluctuated on the average for a five year period between 85 and 686 t/km^2 per year; in parts of the city with the greatest number of industrial enterprises it rose as high as 920 t/km^2, and in gravimetric calculation -- from 0.25 to 8 mg/m^3; according to data compiled by the same author, the sulfur dioxide concentration in the air fluctuated within the limits of 0.009 to 0.76 mg/m^3, and in the vicinity of chemical plants of a 500 m radius it reached 2.39 mg/m^3. According to data compiled by Ryazanov (1954), dust concentration in the air in the vicinity of a large plant fluctuated on various days within the limits of 1.11 to 15.82 mg/m^3.

Versh, Vashkov, and other authors detected still larger concentrations of sulfur dioxide in the vicinity of metallic combines on their leeward side.

As the result of many years of many-sided observations, effective methods of studies were developed and extensive data were collected on the zonal distribution of air pollution near various enterprises.

In evaluating the effect of air pollution on the organism from the positions of Pavlov's physiological teaching on the wholeness of the organism and the environment, Soviet scientists worked out temporary liminally admissible concentrations of most commonly encountered air pollution. The data that has been studied on factual air pollution enabled the scientists to undertake the development of the most effective means of controlling air pollution.

Of great interest are the data on the morbidity of various population groups in regard to specific diseases. In this respect, valuable data had been obtained as far back as in 1933 at the Obukh Institute (cited according to Ryazanov, 1954) in X-ray studies of 19 children living in a village where a large electric power station was in operation. Phenomena of pulmonary fibrosis were detected in these children which were connected, according to the opinion of the authors, with air pollution by the waste material of the power station. Repeated and more extensive studies carried out by the Institute of General and Communal Hygiene of the Acad Med Sci USSR in 1949 confirmed previously detected changes in the lungs of children.

According to foreign data, there has been observed

in recent years a drastic rise in pulmonary cancer in many countries. Study of the cause of this disease led to the assumption that pulmonary cancer was connected with air pollution. This assumption is based on the following fact.

The rise in pulmonary cancer incidence is observed, mainly, in cities and regions where many industrial enterprises are located and where there is heavy motor traffic. The collected data show that the rise in morbidity proceeds parallel to the growth of cities and the industrialization of countries. Substances have been detected in the polluted air which have acknowledged carcinogenic properties (3, 4-benzpyrene).

A number of studies proved experimentally that these contaminations may cause formation of tumors in experimental animals. Thus. for example, in one experiment 76 three-month-old mice were used for a biological study on carcinogenesis. An area of skin between the shoulder blades was swabbed three times weekly with a benzene solution of an extract composed contaminations. The first tumor appeared within 465 days of the start of the experiment. At this time only 31 mice were still alive, and 13 of these had developed tumors. Of 69 control mice, none developed a tumor. Histologically these tumors proved to be benign papillomata with hyperplasia and hyperkeratosis of the epithelium. Subsequently, some of the tumors retrogressed, and nine degenerated into cancer tumors; multiple tumors were formed in some mice. ("Aromatic Carbohydrates. Their Presence in the Air of Los Angeles and the Cancerogenic Property of the Extracts from the Air." A report in the Journal, "Archives of Industrial Hygiene," Vol 9, No 2 pages 153-163, 1954).

The results of studies by Soviet hygienists served as a basis for the promulgation of a law on the protection of air purity. With the implementation of this law, the condition of the air of populated places improved considerably. Thus, according to the data of the Erisman Institute, the pollution of Moscow air has been reduced towfold during the past few years.

To control the condition of the air in the industrial sections of the city, as well as to study the effect of small concentrations of gaseous mixtures on the health of the population, the State Sanitary Inspection of Leningrad suggested that we conduct a study of air pollution and its effect on the health of children in the area of industrial enterprises. The study was carried out in the area of the power station and the coke oven gas plant and in a control

area remote from the sources of air contamination. Simultaneously, a selection of two groups of children totalling 252 individuals was made in the above-mentioned areas. In our study we set ourselves the task of ascertaining the factual and comparative air pollution in the micro-areas adjacent to the above-mentioned enterprises, and to follow up the changes in the indices of the health of children who live in these areas. The study of air pollution was conducted in all seasons and only in one direction, that of the location of schools which corresponded to the residences of the pupils. In each season the quantity of aerosol precipitation and the concentration of sulfur dioxide in the air were determined. Resinous substances were extracted from the precipitated aerosols. The data obtained on air pollution in the industrial and control areas are shown in Table 1, where the aerosols are expressed in grams per square meter per month, resins -- in percentages to the aerosols, and sulfurous anhydride in milligrams per cubic meter of air.

Table 1

Results of Study of Air Pollution in Industrial and Control Areas

Seasons of year	Industrial aria				Control area			
	Aerosols	Resins	SO_2 min.	SO_2 max.	Aerosols	Resins	SO_2 min.	SO_2 max.
Spring.....	105.0	0.79	0.15	0.7	38.1	0.43	0.00	0.2
Summer.....	218.3	7.46	0.20	2.4	73.8	0.22	0.00	0.01
Fall.....	157.8	2.02	0.5	5.6	56.1	0.52	0.00	0.4
Winter.....	420.2	4.04	5.0	7.5	201.5	1.45	0.1	0.3

As seen from the Table, the air contamination in the industrial area was considerably higher than in the control area. The greatest quantity of aerosols is precipitated during the winter and summer, which is connected with heating in winter and a higher amount of dust in the air during the summer. The air of the control area during all seasons was two to three times purer than in the industrial area. The air of the industrial area was also distinguished by a considerable quantity of sulfurous anhydride, the maximum concentration of which was 25 times higher than in the control area.

In the examination of the pupils, two groups alike in age and sex as well as in the economic status of their parents were selected. Children who resided no less than five years in each of the areas were accepted intothe selected groups. Of the pupils in schools within the industrial area, 62 boys and 61 girls from 14 to 17 years of age were selected; 45 boys and 81 girls of the same age were selected from a school within the control area.

In studying the medical charts we concentrated our main attention on the objective data of the examination. According to the X-ray and fluoroscopic data, changes in the lungs or in the lymphatic glands were found in 50 percent of the children residing in the industrial areas. The nature of these changes, according to the roentgenologist's conclusion, boiled down to the accentuation of the pulmonary profile and to consolidation of the lymphatic glands -- more frequently at the pulmonary roots. These changes were most markedly expressed at an earlier age, in children from seven to eight years of age.

Among the children of the control area these changes were observed in only 11 percent of those examined; there was a certain accentuation in regard to the earlier age group. The data obtained do not permit a categorical assertion that in this instance we came across some specific changes which are directly dependent on the effect of aerosols and sulfurous anhydride. However, when we consider that the examined groups of individuals had not been subjected to the effect of specific noxious agents, and that, as homogenous groups, they differed from each other in respect to living conditions by residing in areas distinct in their degree of air pollution, it is perfectly natural to infer that a greater contamination of the air with aerosols and sulfurous anhydrides enhanced the effect of other pathological factors and caused the pulmonary changes in the examined children.

The result of this study may serve as a basis for carrying out more decisive measures on the protection of air purity in the cities and areas adjacent to industrial enterprises.

Bibliography

Babayants, R. A. Polution of City Air. Publishing House of the Acad Med Sci USSR, Moscow, 1948

Babayants, R. A., Methods and Results of Air Pollution of Leningrad. Gigiyena i Sanitariya (Hygine and Sanitation), No 9, 1944

Versh, V. M.; Vashkov, V. I., Contamination of the Surrounding Area with Industrial Dust, Fumes, and Gases. Gigiyena i Sanitariya, No 7, 1937.

Volkova, N. V., Effect of Sulfur Dioxide on Organisms. Collection of Works LSGMI (Len San Hyg Med Inst), Vol 26, 1956.

Vol'fson, Z. G., On the Effect of Air Contamination with Carbon Monoxide on Human Beings. Sovetskiy Vrach (Soviet Physician), No 9, 1936.

Lykova, A. S., Carbon Monoxide in the City Air and its Effect on the Organism. Collection of Works LSGMI. Vol 26, 1956.

Nikulina, M. M. ; Getman, Ts. Yu.; Margolina, N. M., Morphological and Biochemical Blood Changes in Acute Intoxication with Sulfurous Anhydride. Trudy Leningradskogo Instituta Profesional'nykh Zaboleveniy. (Works of the Leningrad Institute of Occupational Diseases), Vol 8, Leningrad, 1934.

Ryazanov, V. D., Sanitary Protection of the Air, Medgiz, 1934.

Sidorenko, I. V., Effect of Sulfurous Anhydride on the Oxidation Processes and the Nervous System. Second All-Union Conference on the Problems of Industrial Toxicology. Publishing House of the Acad Med Sci USSR, Moscow, 1952

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